REMARKS

Claims 1-6, 8-19, 21-31, 33-44, 46-55, 57-65 and 67-70 are pending in the application. Claims 1-6, 8-19, 21-31, 33-44, 46-55, 57-65 and 67-70 are rejected. Amendments to the application are shown above. The Applicant respectfully requests reconsideration of the application in view of the amendments and the following remarks.

Rejections under 35 U.S.C. § 101

Claims 1-70 are rejected under 35 U.S.C. § 101 because the claimed invention allegedly is directed to non-statutory subject matter. The Examiner recites that the claimed invention lacks a real-world practical application. The Applicant respectfully traverses the rejection.

In accordance with the *Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility* (OG Notices, 22 Nov. 2005) and MPEP 2106, the Examiner must first determine if the claimed invention falls within at least one of the four enumerated categories of patentable subject matter recited in § 101 (process, machine, manufacture of composition of matter). The Examiner must then determine if the claim falls within one of the § 101 judicial exceptions (abstract idea such as a mathematical algorithm, natural phenomenon, and law of nature).

For claims including a judicial exception, the claims must be for a "practical application" of the judicial exception. For a practical application, the claimed invention transforms an article or physical object to a different state or thing or the claimed invention produces a "useful, tangible, and concrete result."

While the Applicant does not admit that claims 1-70 fall within a judicial exception, in order to expedite prosecution, the Applicant will assume here that the

claimed invention falls within a judicial exception and show that the claimed invention is for a practical application of a judicial exception because it produces a "useful, tangible, and concrete result."

Claim 1 as presently amended recites "a computer implemented method for minimizing effects of outlier data on data modeling." Independent claims 14, 27, 39, 50 and 61 recite similar limitations.

1) Useful. To be useful, the claimed invention must meet the utility requirements of § 101. The utility requirement is met when the Applicant has asserted that the claimed invention is useful for any particular practical purpose (i.e., it has a "specific and substantial utility") and the assertion would be considered credible by a person of ordinary skill in the art (MPEP 2107).

A purpose for the Applicant's claimed invention is for obtaining a robust data model as to outliers. This purpose has utility to one of ordinary skill in the art because it reduces errors in determining data clusters due to the presence of outlier data. The Applicant's specification provides multiple examples of this purpose (page 15, lines 17-24). Such a purpose is not "throw away", but credible to one of ordinary skill in the art.

In one example (page 15, lines 17-20), speech data is modeled to determine the correct number of speakers in a room. In this example, the claimed invention may be utilized in sound source localization to determine where speech sounds are clustered in relation to a microphone. The claimed invention minimizes the affects of outlier speech data that may be erroneously identified as a speaker. Thus, the presently claimed invention meets the useful result requirement.

2) Tangible. To be tangible, the process claim must set forth a practical application of that judicial exception to produce a real-world result. The Applicant thanks the Examiner for acknowledging that the claimed invention provides a tangible output (see, Final Office Action, June 15, 2007, page 3). Further, claim 1 expressly recites "minimizing

effects of outlier data on data modeling." This produces a real-world result, that is, a data model that is robust as to outliers.

As recited above, the Applicant's specification provides multiple examples of a useful, tangible, and concrete result (page 15, lines 17-24). In another example, image data is modeled. The claimed invention provides modeling of large homogenous regions of image data without being noticeably affected by small regions having different characteristics. These small regions are considered outliers as to the homogenous regions. In this example, the claimed invention provides the real-world application of correctly modeling the large homogenous region without introducing errors caused by the outlier data (i.e., the small regions of different characteristics).

The Applicant submits that the claimed invention provides a real-world result of minimizing the affects of outliers on data modeling. Thus, the presently claimed invention meets the tangible result requirement.

3) Concrete. To be concrete, the process must have a result that can be substantially repeatable or the process must substantially produce the same result again. The opposite of "concrete" is unrepeatable or unpredictable. The Applicant submits that the claimed invention will substantially produce the same result (i.e., same data model) each time the set of input data is introduced into the claimed invention (assuming all other factors remain the same). Thus, the presently claimed invention meets the concrete result requirement.

Having shown that the claimed invention produces a useful, tangible, result, the Applicant respectfully submits that the claimed invention is for a practical application of a judicial exception and thus satisfies § 101 requirements. Accordingly, the Applicant respectfully requests that the instant § 101 rejections be withdrawn.

Rejections under 35 U.S.C. § 112P1

Claims 1-70 are rejected under 35 U.S.C. § 112P1 as allegedly failing to comply with the written description requirement. The Office Action states that the specification does not explain what makes an approximation "tractable." The Examiner asks "how is a "tractable" approximation performed?" The Examiner also asserts that the specification does not define what makes an approximation tractable. This rejection is respectfully traversed.

To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. There is a strong presumption that an adequate written description of the claimed invention is present when the application is filed (emphasis added) (MPEP 2163).

MPEP 2163 also states that the written description standard is fulfilled by both what is specifically disclosed and what is conventional or well known to one skilled in the art.

> What is conventional or well known to one of ordinary skill in the art need not be disclosed in detail. See *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d at 1384, 231 USPQ at 94. See also *Capon v. Eshhar*, 418 F.3d 1349, 1357, 76 USPQ2d 1078, 1085 (Fed. Cir. 2005)("The 'written description' requirement must be applied in the context of the particular invention and the state of the knowledge.... As each field evolves, the balance also evolves between what is known and what is added by each inventive contribution."). **If a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met.** See, e.g., *Vas-Cath*, 935 F.2d at 1563, 19 USPQ2d at 1116; *Martin v. Johnson*, 454 F.2d 746, 751, 172 USPQ 391, 395 (CCPA 1972) (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient") (emphasis added).

The Applicant submits that one skilled in the art would recognize that the Applicant had possession of the claimed invention at the time of filing. First, the Applicant expressly teaches a "tractable approximation" in the specification. The Examiner's attention is directed to page 9, lines 9-15, of the Applicant's specification as originally filed and repeated here:

> Exact inference of the Bayesian model is intractable. However, with the choice of exponential distributions to represent the prior distributions of the modeling parameters, tractable approximations are possible. In one implementation, for example, a tractable approximation may be obtained through Monte Carlo techniques. In another implementation, variational inference may be employed to obtain tractable approximations (emphasis added).

The Examiner asks "how a tractable approximation is performed"; the Applicant expressly teaches in the specification that a tractable approximation may at least be generated using Monte Carlo techniques or variational inference (e.g., page 9, lines 13-14; page 18, lines 4-5). Also, computing a tractable approximation using a variational inference is described in detail on at least pages 9-14 of the specification. Equations (12), (18), (22), (25), and (28) show how to compute tractable approximations for the following modeling parameters (respectively): labeling parameters, mixing coefficients, mean of a Student distribution, precision matrix of a Student distribution component, and scaling parameters.

Second, the Applicant respectfully submits that the Examiner has not given enough consideration as to what the application discloses when read through the eyes of one having ordinary skill in the art. The term "tractable" in the context of data analysis is known to those having ordinary skill in the art. For example, the Examiner's attention is directed to at least US Patent 7,184,993[1] titled "Systems and methods for tractable variational approximation for interference in decision-graph Bayesian networks" filed June 10, 2003, first named inventor Heckerman, and assigned to the same assignee as the instant application. As stated in the Abstract of US '993:

> The present invention leverages approximations of distributions to provide tractable variational approximations, based on at least one continuous variable, for inference utilization in Bayesian networks where local distributions are decision-graphs. These tractable approximations are employed in lieu of exact inferences that are normally NP-hard to solve (emphasis added).

[1] Applicant does not admit that this patent is prior art. Applicant respectfully brings this patent to the attention of the Examiner solely for the purpose of showing the use of "tractable" by one of ordinary skill in the art.

In view of the above, the Applicant submits that the instant § 112P1 rejections as to the written description requirement have been overcome. Accordingly, the Applicant respectfully requests that the written description requirement rejections be withdrawn.

Rejections under 35 U.S.C. § 112P2

Claims 1-70 are rejected under 35 U.S.C. § 112P2 as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter of the invention. The Office Action states that the term "tractable" is relative and ambiguous, and therefore renders the claims indefinite. The Applicant respectfully traverses the rejection.

Definiteness of claim language must be analyzed in light of: a) the content of the application disclosure, b) the teachings of the prior art, and c) the claim interpretation by one of ordinary skill in the art at the time of invention (MPEP 2173.02). As recited above, the instant specification clearly defines "tractable." The Applicant expressly teaches in the specification that a tractable approximation may at least be generated using Monte Carlo techniques or variational inference (e.g., page 9, lines 13-14; page 18, lines 4-5). Also, a tractable approximation using a variational inference is described in detail on at least pages 9-14 of the specification. Furthermore, Applicant respectfully asserts that the term "tractable" is well known to one of ordinary skill in the art.

In view of the above, the Applicant submits that the instant § 112P2 rejections as to indefiniteness have been overcome. Accordingly, the Applicant respectfully requests that the indefiniteness rejections be withdrawn.

Rejections under 35 U.S.C. § 102 and § 103

Claims 1-6, 8-11, 14-19, 21-24, 27-31, 33-36, 39-44, 46-55, 57-65 and 67-70 are rejected under 35 U.S.C. 102(b) as being anticipated by Heckerman (US 5,704,018). Claims 12-13, 25-26, and 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heckerman (US 5,704,018) and further in view of Official Notice.

The Applicant respectfully traverses the rejection.

Independent claim 1

Claim 1 expressly recites (emphasis added):

1. A computer-implemented method for minimizing effects of outlier data on data modeling comprising:

selecting a modeling parameter from a plurality of modeling parameters characterizing a mixture of Student distribution components;

computing a tractable approximation of a posterior distribution for the selected modeling parameter based on an input set of data and a current estimate of a posterior distribution of at least one unselected modeling parameter in the plurality of modeling parameters;

computing a lower bound of a log marginal likelihood as a function of current estimates of the posterior distributions of the modeling parameters, the current estimates of the posterior distributions of the modeling parameters including the computed tractable approximation of the posterior distribution of the selected modeling parameter;

determining if the lower bound has been satisfactorily optimized, wherein the lower bound is satisfactorily optimized when the computed lower bound has changed less than a threshold amount from a previously computed lower bound;

generating a probability density modeling the input set of data, the probability density including the mixture of Student distribution components, the mixture of Student distribution components being characterized by the current estimates of the posterior distributions of the modeling parameters, when the lower bound is satisfactorily optimized; and

outputting the probability density.

Heckerman does not disclose computing an approximation of a posterior distribution for a modeling parameter. First, Heckerman does not compute an approximation of a posterior distribution. Second, Heckerman does not compute an approximation of a posterior distribution of a modeling parameter.

The claimed invention uses posterior distributions of modeling parameters rather than the modeling parameters themselves. Example modeling parameters include a mean, a precision matrix, a labeling parameter, a scaling parameter, and a mixing coefficients parameter of a Student distribution. Example equations for computing a tractable approximation for these modeling parameters are shown by Applicant's equations (12), (18), (22), (25), and (28).

Heckerman discloses filling in missing data in a discrete score case and a continuous score case. In the discrete score case, the discrete score routine "approximates the density for each parameter set {...} to be a Dirichlet distribution when there is missing data" (col. 10, lines 57-62; emphasis added). However, the Examiner has not shown how Heckerman approximates a posterior distribution for each parameter set.

Also, the parameter set includes parameters associated with variables in the test network. Heckerman specifically defines "variables" as corresponding to the states of "nodes" (col. 2, lines 5-25). An example discrete variable is a Boolean variable (true or false) and an example continuous variable is a variable that can assume any real value between -1 and 1. So "variables" in Heckerman should not be confused with modeling parameters in a Student distribution. Thus, even if one was to assume that for the discrete score case Heckerman approximates a posterior distribution, this approximation is for variables, not for modeling parameters characterizing a mixture of Student distribution components.

In the continuous score case, Heckerman generates continuous scores by filling in missing data in empirical data (col. 16, lines 18-37). For filling in the missing data, Heckerman inserts the mean of a variable having the missing data into the empirical data using a provided formula. A term in the formula is a "univariate t distribution".

However, the Examiner has failed to show how these operations constitute approximating a posterior distribution.

Also, even if one was to assume that for the continuous score case Heckerman approximates a posterior distribution, this approximation is for variables, not for modeling parameters characterizing a mixture of Student distribution components.

Thus, Heckerman fails to disclose "computing a tractable approximation of a posterior distribution for the selected modeling parameter based on an input set of data and a current estimate of a posterior distribution of at least one unselected modeling parameter in the plurality of modeling parameters" as expressly claimed by the Applicant.

Thus, Heckerman fails to disclose at least one of the expressly recited limitations of claim 1. Accordingly, claim 1 is not anticipated by Heckerman. Independent claims 14, 27, 39, 50, and 61 distinguish for at least the same reason as claim 1. Claims 2-13, 15-26, 28-38, 40-49, 51-60, and 62-70 are dependent claims and distinguish for at least the same reasons as their independent base claims in addition to adding further limitations of their own. Therefore, the Applicant respectfully requests that the instant § 102 and § 103 rejections be withdrawn.

Dependent claim 2

While the Applicant submits that claim 1 is allowable as discussed above, the Applicant presents the patentability of claim 2 over cited reference Heckerman.

Dependent claim 2 expressly recites:

The method of claim 1 wherein the computing operations comprise a first iteration and further comprising:

selecting a different modeling parameter from the plurality of modeling parameters and repeating in a subsequent iteration the operations of computing a tractable approximation and computing a lower bound using the newly selected modeling parameter, if the lower bound is not satisfactorily optimized in the first iteration.

On page 11 of the Office Action, the Examiner cites Heckerman, col. 6, lines 32-56, as disclosing the claim limitations of claim 2. The Applicant respectfully disagrees.

Heckerman discloses iterating between scoring mechanism 602 and network adjuster 606 and generating an improved belief network 508 when scores 604 generated do not improve (col. 6, lines 36-41; Figure 6). Network adjuster 606 adjusts a previously generated test network in an attempt to generate a new test network with a better score than the previously generated test network.

Heckerman describes generating a new test network by network adjuster 606 (col. 18, line 20, to col. 19, line 40; Figure 11A-11B). In generating a new test network, Heckerman determines a new sub-score for each legal change to a node (col. 19, lines 10-11). This is done for each node in the test network (col. 19, line 30-35). It will be noted that while Heckerman uses the term "variables" in the test network in column 19, Heckerman specifically defines "variables" as corresponding to the states of "nodes" (col. 2, lines 5-25), so "variables" in Heckerman should not be confused with modeling parameters in a Student distribution.

After all the nodes have been processed, the network adjuster identifies the single best change that most improves the total score of the test network. To adjust a test network, Heckerman walks through the nodes making changes and computing new sub-scores. Heckerman does not select a new modeling parameter. Thus, Heckerman iterates through nodes and does not iterate through modeling parameters as claimed by the Applicant.

Thus, Heckerman does not disclose "selecting a different modeling parameter" and iterating through operations of claim 1 as recited in claim 2.

New Claim 71

The Applicant submits that new claim 71 is allowable based on its dependency from allowable independent claim 1. No new matter has been added; the Examiner's

attention is directed to at least page 8, lines 6-12, of the Applicant's specification as originally filed.

It is noted that Heckerman relies on "expert knowledge" and "empirical data" (col. 4, lines 25-34; col. 5, lines 36-37) while in contrast Applicant's claim 71 expressly recites using observed (i.e., empirical) data only. One of ordinary skill in the art would not be motivated to exclude expert knowledge from Heckerman because Heckerman expressly discloses the advantage of using both expert knowledge and empirical data in its system to generate more accurate belief networks than conventional belief networks (col. 19, lines 42-46).

Conclusion

Accordingly, in view of the above amendment and remarks it is submitted that all the rejections and/or objections to the application have been overcome. Based on the foregoing, Applicant respectfully requests that the application be allowed, and that a timely Notice of Allowance be issued in this case. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is invited to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension of time fee that is not covered by an enclosed payment, please charge any deficiency to Deposit Account No. 50-0463. Any overpayment may be credited to the same account.

Respectfully submitted,
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